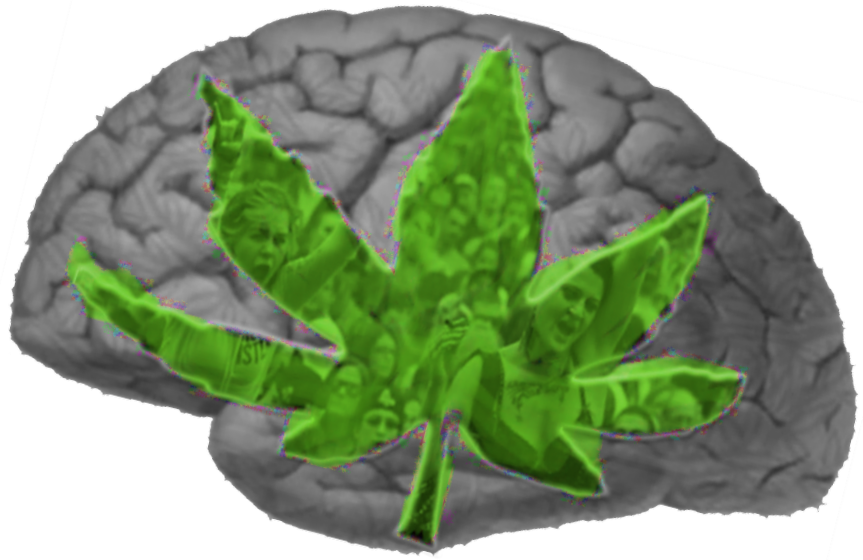
consequences?



marijuana and the teen brain

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UCSD

in this talk

what is marijuana?

the brain on marijuana

is the teen brain special?

current research

what is marijuana?

cannabis sativa plant

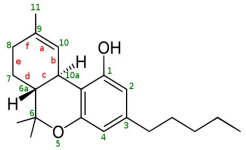
leaves, stems flowers

delta-9-tetrahydrocannabinol

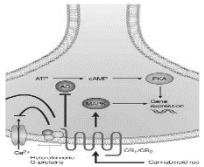
= $\Delta^{9\text{-}}$THC

main psychoactive ingredient

Δ^9-THC is the main psychoactive ingredient

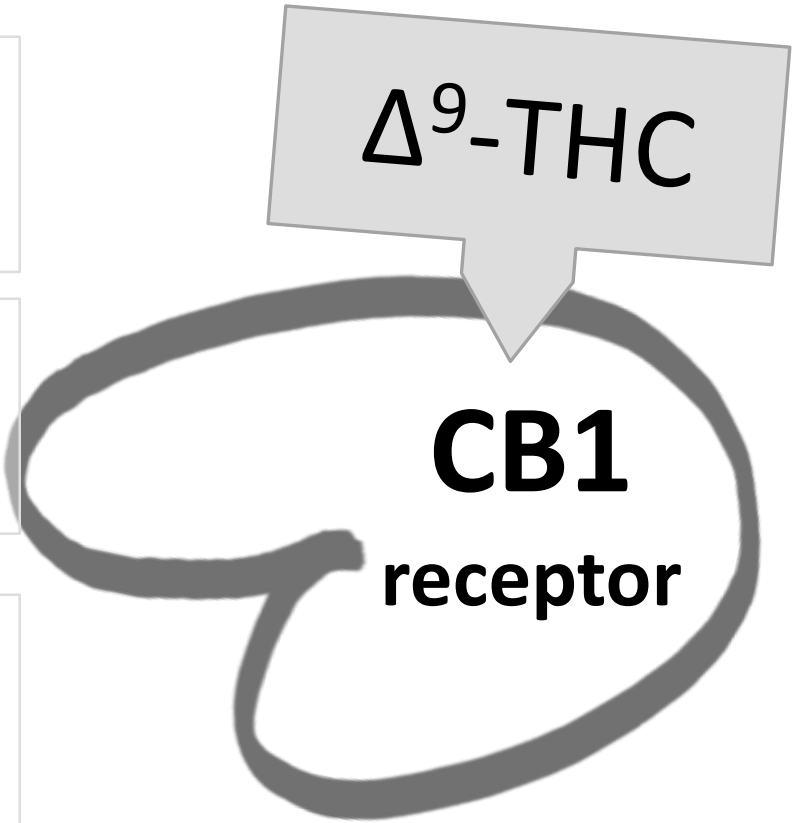


Δ^{9}-THC activates cannabinoid1 (CB1) receptor in the brain.



CB1 is expressed at high levels in many brain areas

Two endogenous brain lipids have been identified as CB1 ligands



endocannabinoids – ligands for CB_1

N-arachidonylethanolamine

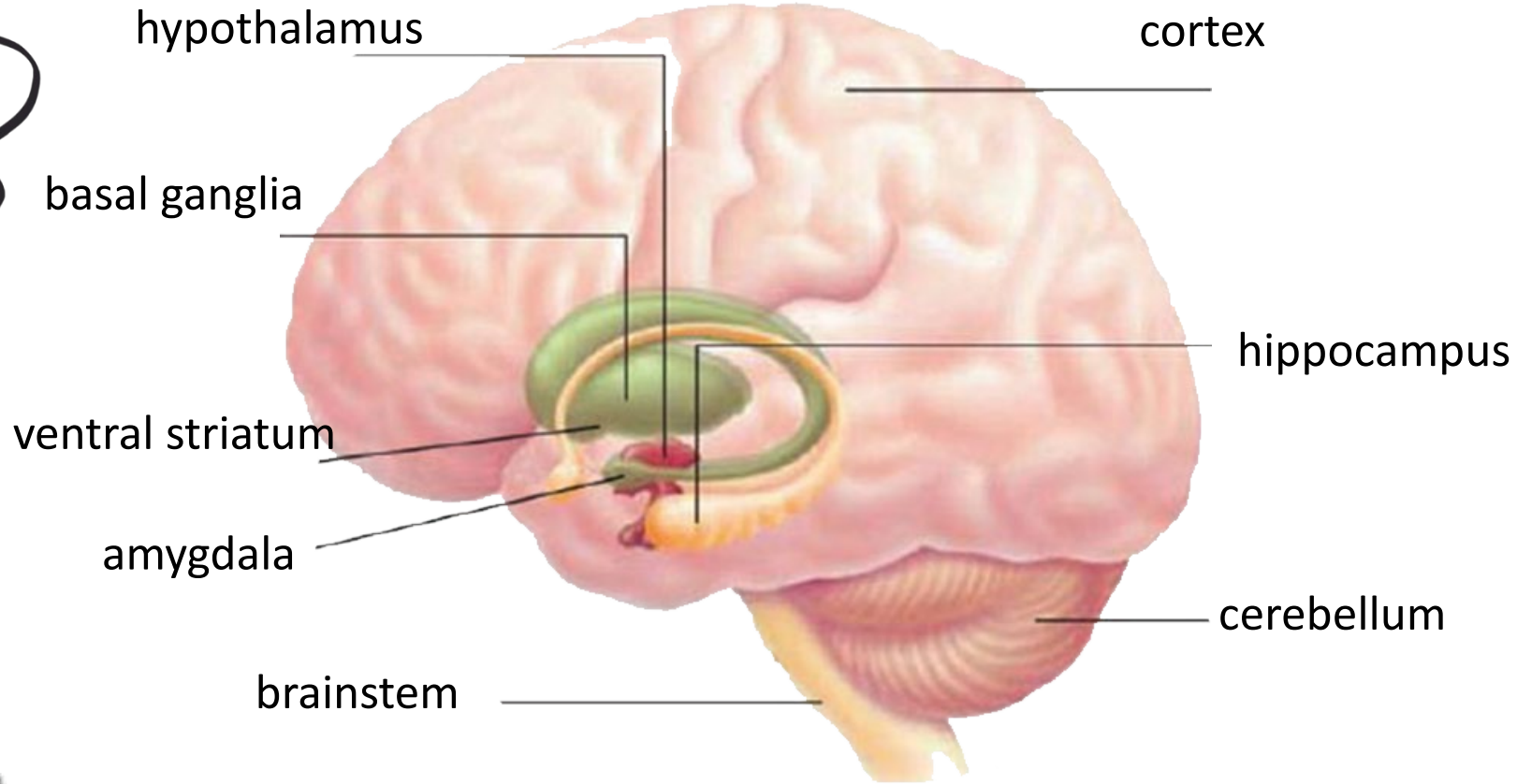
anandamide (AEA)

arachidonate-derived neuroactive lipids

2-arachidonoylglycerol

2-AG

what areas of the brain process marijuana?

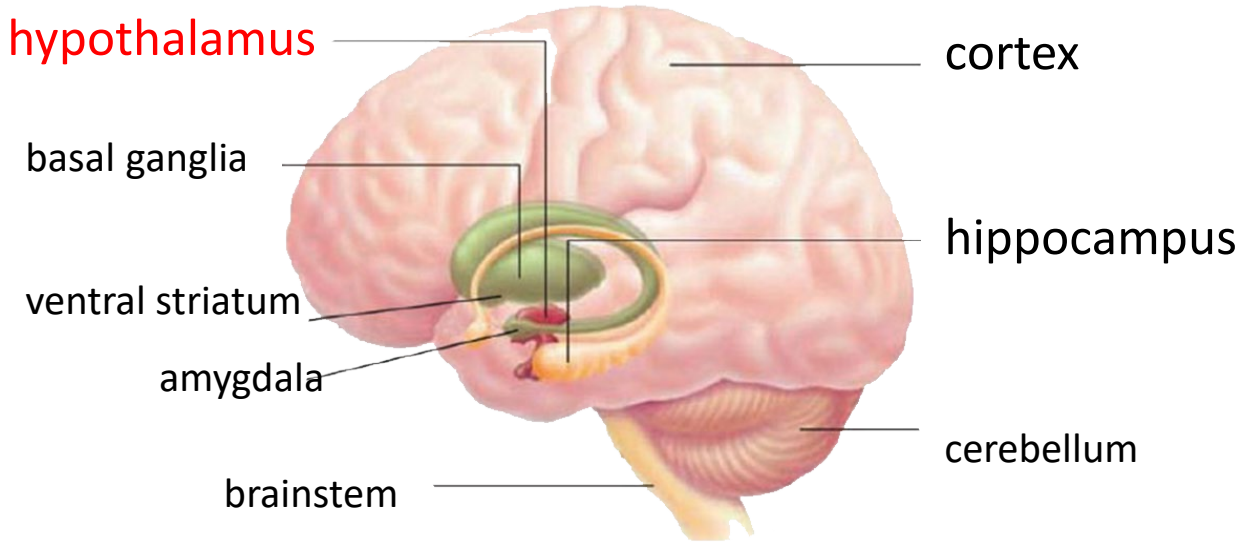


hormones

appetite

circadian rhythms

sexual behavior



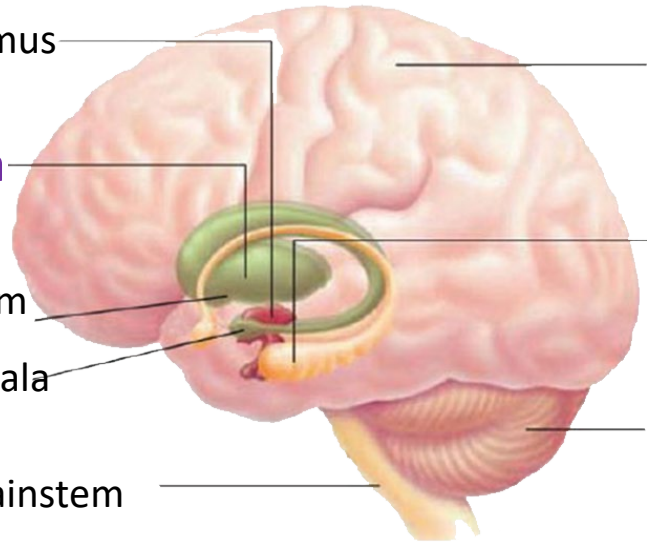
motor controlled planning

initiation of actions

termination of actions

habit pathway

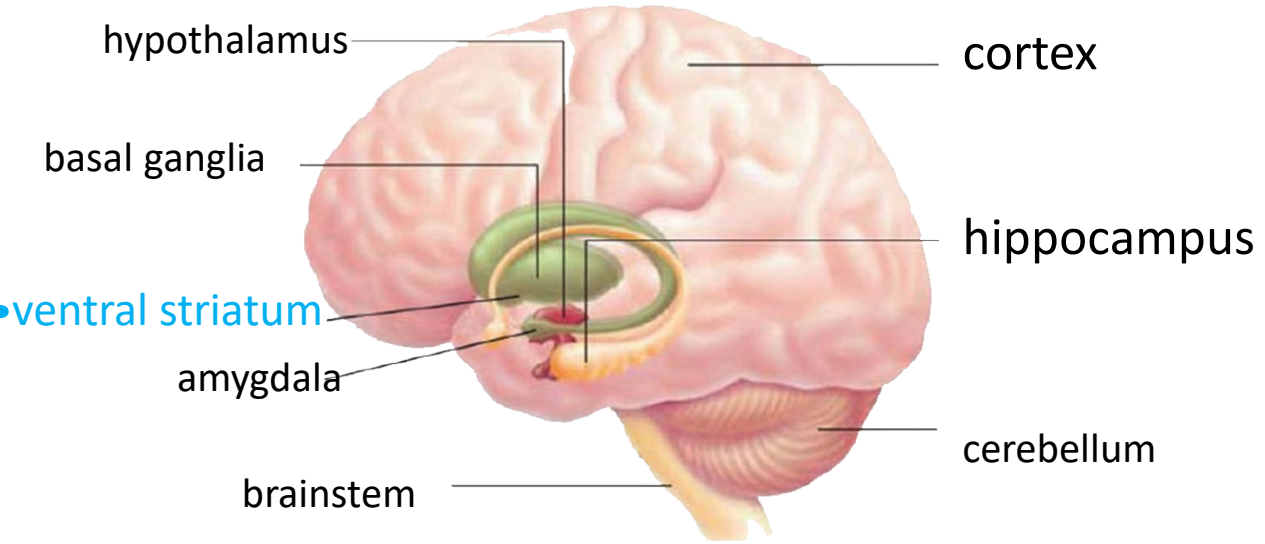
basal ganglia



prediction

reward

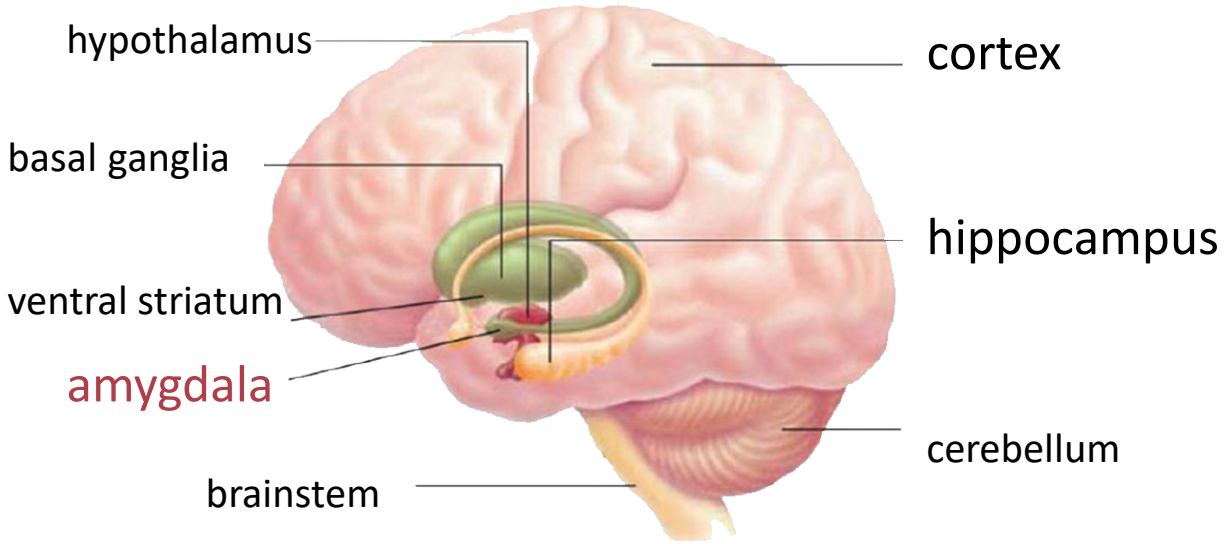
addiction?



anxiety

emotion

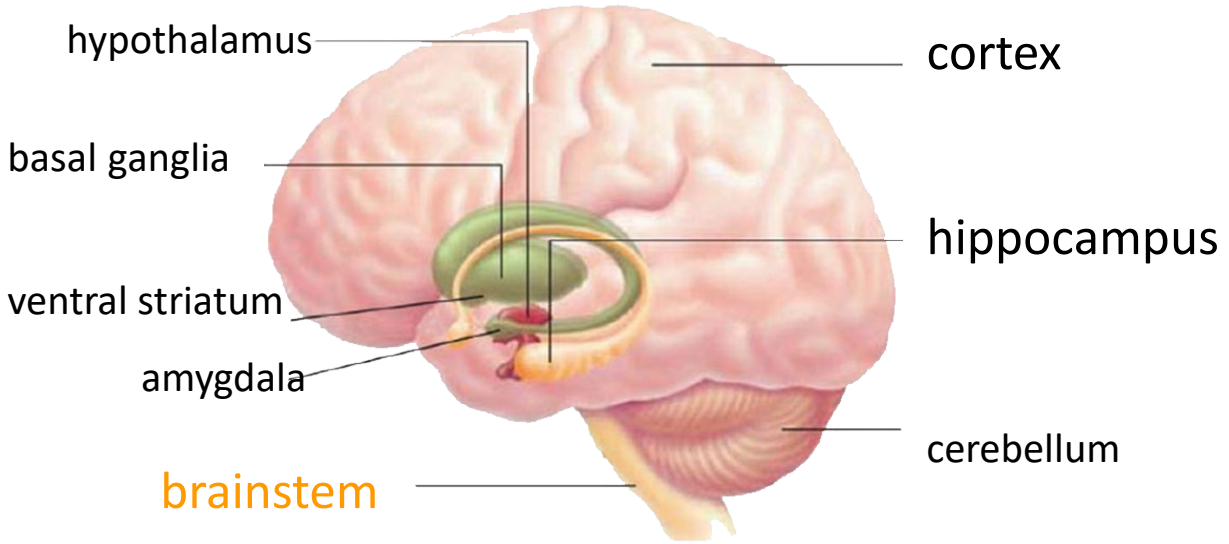
fear

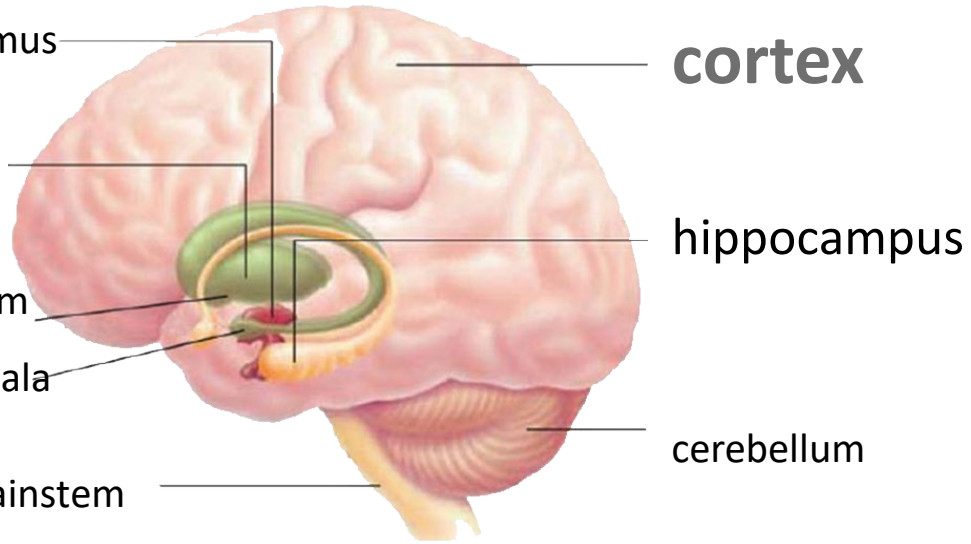


vomiting reflex

pain sensation

sympathetic nervous system reactions

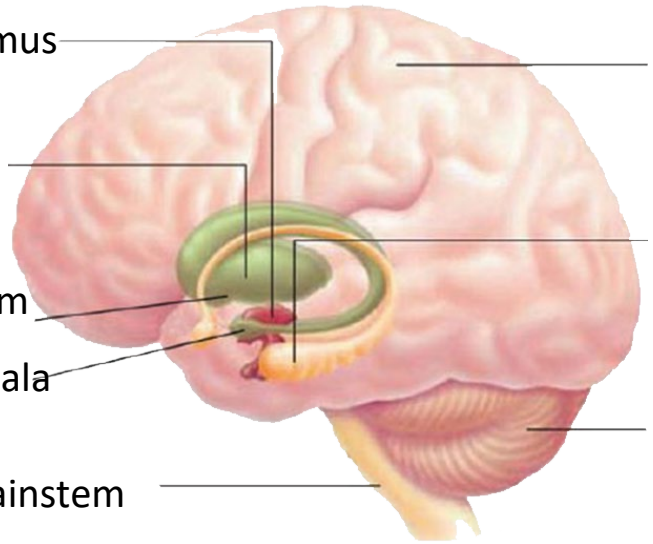




higher cognitive functions

sensation perception

judgment and pleasure

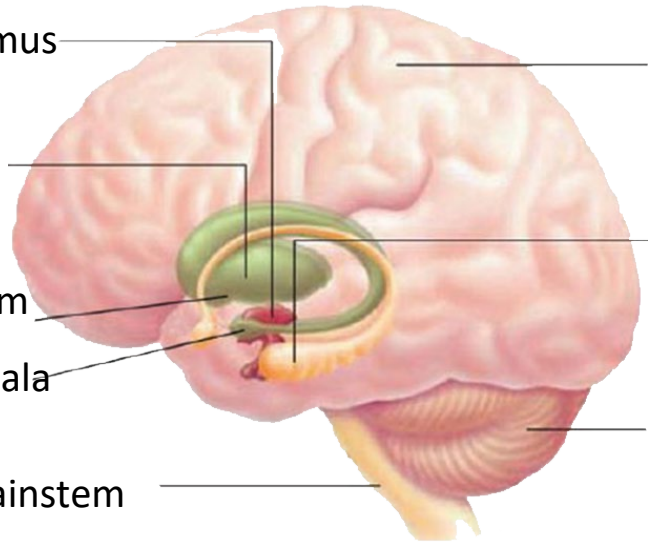


memory formation

learning: facts

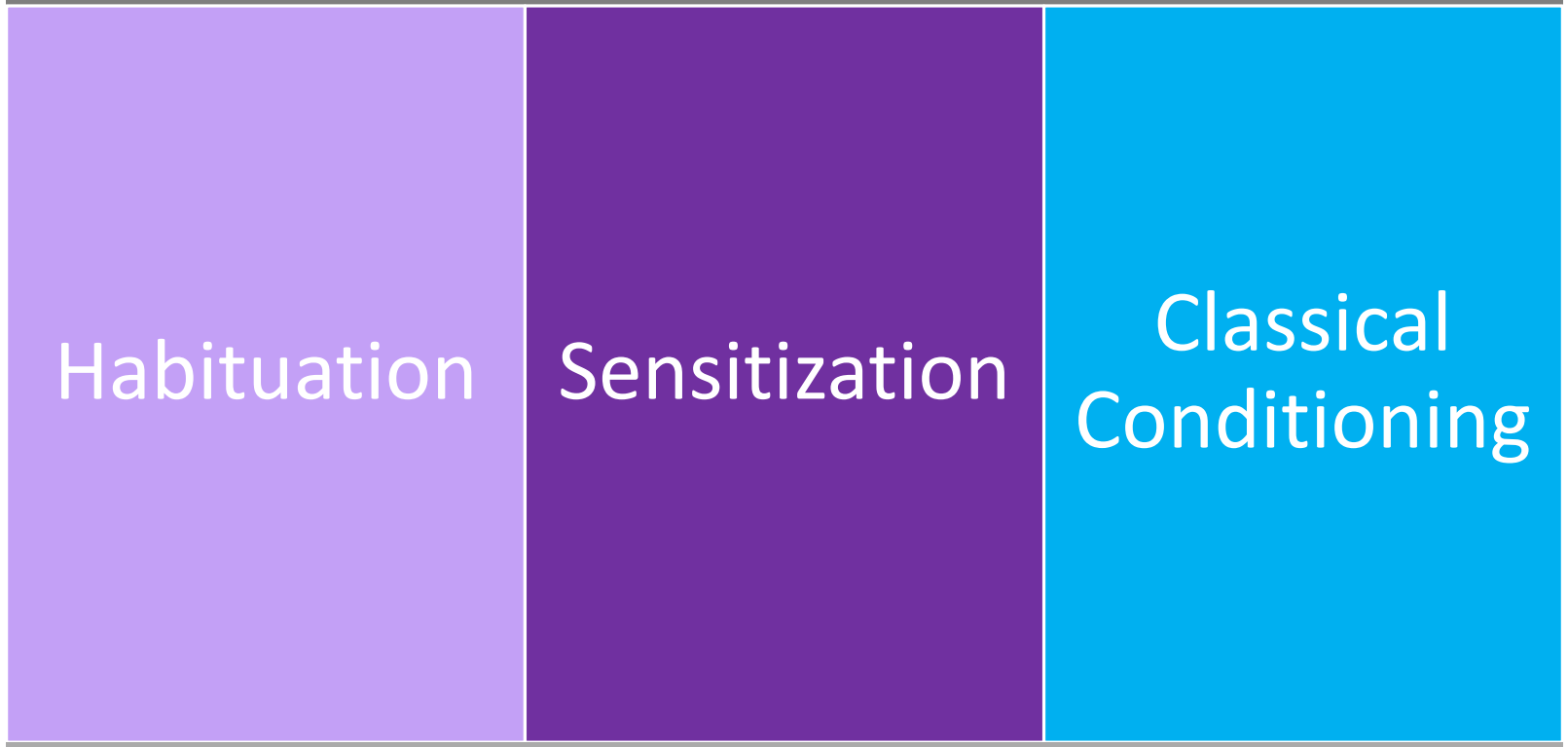
sequences

places



- motor control
- coordination
- motor learning
- doubles risk of car accident - DUI

Three Types of Implicit Learning



habituation

Most simple form of learning

Initial response to stimuli:
very defensive -

Repeated exposure to stimuli:

Response is muted - Eventually ignored.

Purpose:
Animal needs to learn which stimuli to safely ignore

Eliminates inappropriate or
exaggerated defense responses

Important for:
Organizing perception

sensitization

Sensitization – mirror image of habituation

After a noxious stimulus

the sensitized animal respond more strongly to all stimuli.

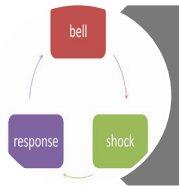
Purpose:
Instead of ignoring a stimulus – it is a form of learned fear. Survival.

It teaches the animal to attend and respond more vigorously to almost any stimulus

Konrad Lorenz: “An earthworm that has just avoided being eaten by a blackbird … is indeed well advised to respond with a considerably lowered threshold to similar stimuli because it is almost certain that the bird will still be nearby for the next few seconds.”

classical conditioning

Aversive Classical Conditioning



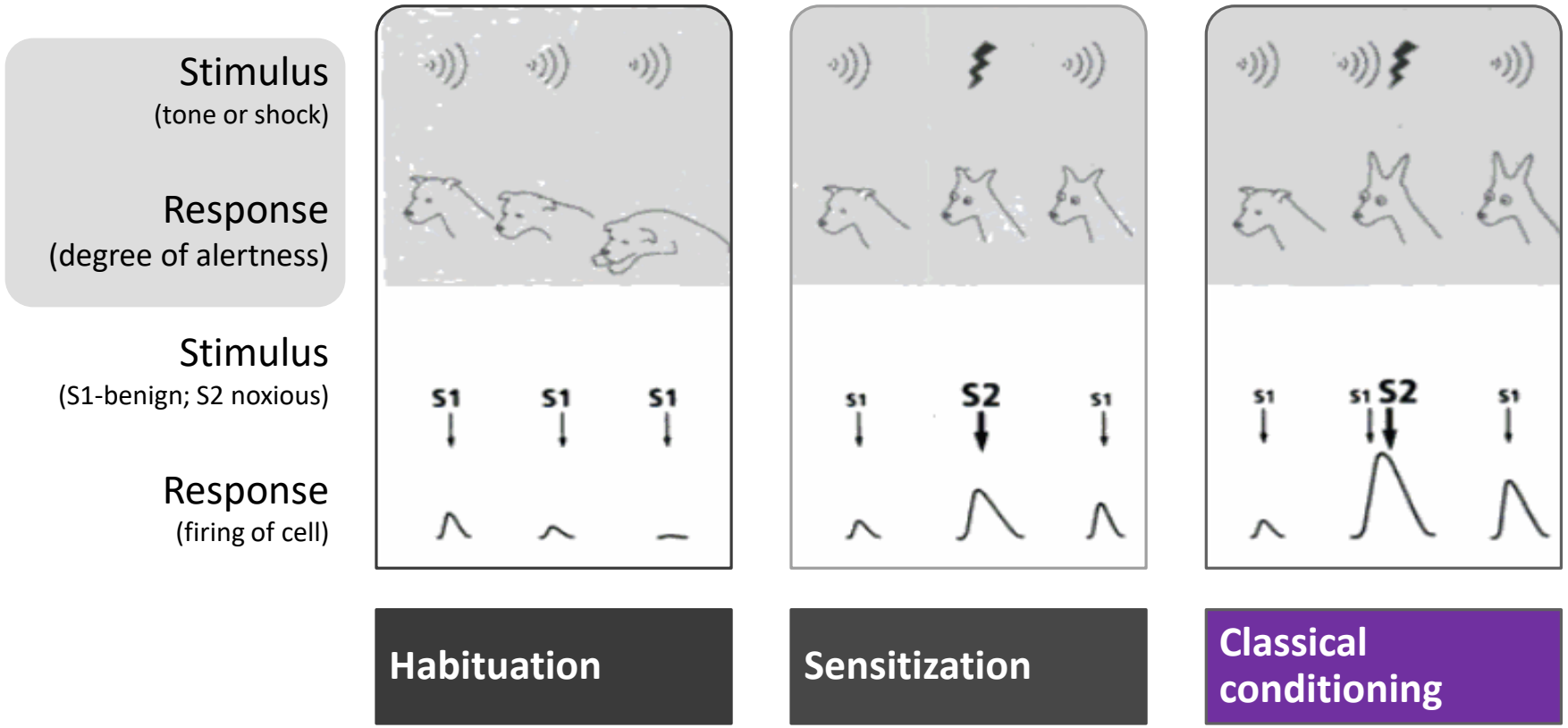
A neutral stimulus must always precede the aversive stimulus – that way the animal will come to predict it.

Pavlov: shock a dog's paw. The shock caused the animal to raise and withdraw its leg – a fear response.

Pavlov found that after several trials in which he paired the shock with a bell – first sounding the bell then the shock – the dog would withdraw his paw whenever the bell sounded.

Classical conditioning an association is formed between a pair of stimuli that occur in rapid sequence.

Teaches the animal to associate an unpleasant stimulus with a stimulus that ordinarily elicits no response.



Synaptic strength is not fixed – it can be altered in different ways by different patterns of activity.